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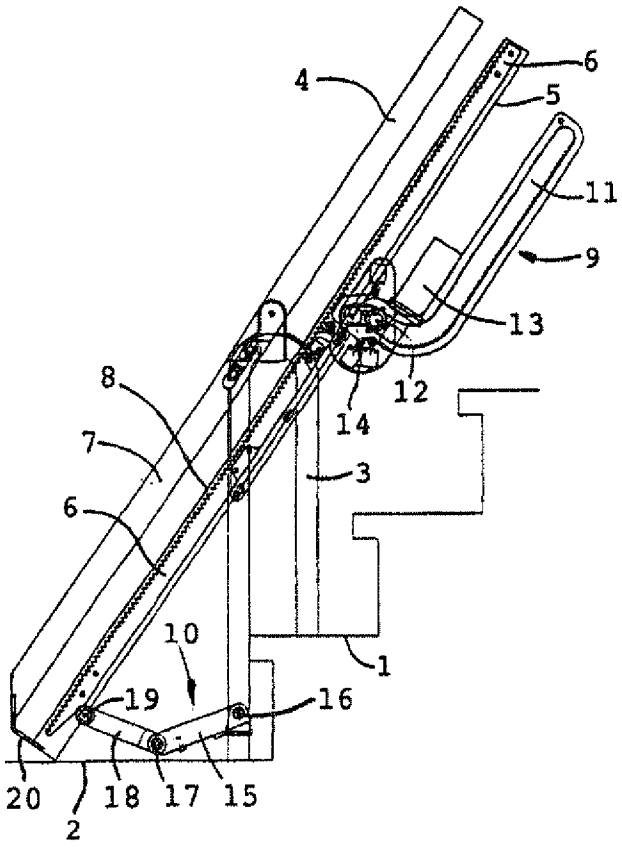
(57) Abstract

A rail system for a staircase elevator, whereby the rail comprises two tubes (4, 5) having a substantially circular cross section, which are mounted substantially one above the other in spaced-apart relationship, said rail system being provided with a rail which can be fixedly mounted with respect to the staircase and a rail portion (7, 8) which can be moved by guide means between a first position, in which each of the tubes of said rail portion is contiguous to the lower end of the corresponding tube of the fixed rail, and a telescoped position, in which the two tubes of said rail portion are at least partially positioned under the two tubes of the fixed rail. The guide means comprise a connecting element, which is on the one hand pivotably connected to the rail portion, near the lower end thereof, and which is on the other hand pivot-mounted at a fixed location with respect to the staircase. The connecting element comprises a first portion and a second portion, which portions are pivotably interconnected.



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RAIL SYSTEM FOR A STAIRCASE ELEVATOR

The invention relates to a rail system for a staircase elevator, whereby the rail comprises two tubes having a substantially circular cross-section, which are mounted substantially one above the other in spaced-apart relationship, said rail system being provided with a rail which can be fixedly mounted with respect to the staircase. A rail system of this type is known from NL-A-9402200.

A staircase elevator comprising such a rail system may be provided with an elevator in the form of a chair, on which a disabled person can move up and down along a staircase in seated position. In order to be able to move such an elevator to a position on the floor at the bottom side of the staircase, it is necessary that the rail of the rail system extends beyond said staircase, and that above said floor.

The rail of such a rail system may block the passage at the bottom side of the staircase or be otherwise in the way, and consequently it is usual to design the lower end of the rail in the form of a rail portion which can be swung or moved aside. Said swinging may take place in upward or in lateral direction, for example in the manner described in EP-B-0408716.

Said swinging or moving of a rail portion in the known manner can be readily effected if the rail consists of a single guide, it is more difficult to realise, however, when said rail consists of two separate guides.

The object of the invention is to provide a rail system comprising a rail which consists of two tubes mounted one

above the other in spaced-apart relationship, whereby a rail portion present at the bottom side of the rail system can be moved in an efficient manner to a position in which it does not block the passage.

In order to accomplish that objective the rail system comprises a rail portion which can be moved by guide means between a first position, in which each of the tubes of said rail portion is contiguous to the lower end of the corresponding tube of the fixed rail, and a telescoped position, in which the two tubes of said rail portion are at least partially positioned under the two tubes of the fixed rail. As a result of that both tubes of the movable rail portion will be positioned under the bottom tube of the fixed rail, so that the cross connections between the two tubes of the movable rail portion cannot block said moving aside.

The guide means for moving the rail portion aside may be provided with a guideway, by means of which the upper side of said rail portion can be moved in a desired path. A guideway of this type will be explained in more detail by means of an embodiment.

According to another aspect of the invention said guide means furthermore comprise a connecting element, which is on the one hand pivotably connected to said rail portion, near the lower end thereof, and which is on the other hand pivot-mounted at a fixed location with respect to the staircase, said connecting element comprising a first portion and a second portion, which portions are pivotably interconnected. A pivotable connecting element is a simple construction for guiding the lower end of the rail portion. By designing said connecting element as a unit consisting

of two pivotably interconnected portions, the lower end of the rail portion can be guided in a path other than a circular path, which in practice makes it possible for the rail portion to move in an advantageous manner.

In a preferred embodiment said connecting element comprises three horizontal pivot pins extending parallel to each other, a first pivot pin at one end of said first portion, which pivot pin is present at a fixed location with respect to the staircase, a second pivot pin at the other end of said first portion, about which pivot pin also the second portion can pivot, and a third pivot pin at the end of said second portion, which pivot pin is present at a fixed location on the rail portion. In said first position of the movable rail portion the three pivot pins preferably do not lie in one plane, but the second pivot pin is positioned some distance under the plane in which said first and said third pivot pin lie. This will be explained in more detail by means of an embodiment.

According to the invention an adjustable stop may be provided for adjusting the lowermost position of the first portion of the connecting element.

According to the invention the connecting element may furthermore be attached to the lower tube of said rail portion, whereby the two tubes of the rail portion are interconnected, so that they can be jointly moved. Preferably the rail system will remain spaced from the floor at the bottom side of the staircase in any position of said rail portion, so that the floor can be provided with any desired kind of floor covering.

A general problem connected with the moving of a lower rail portion of a staircase elevator is the secure fixing of said lower end of said rail portion and the guiding of said lower end, which problem may be solved by using the above-described connecting element, by means of which the aforesaid lower end can be securely fixed and be moved in an advantageous path. In that case the above-described connecting element may also be considered to constitute an invention, which, besides being used in conjunction with the above-described rail system, may also be used for other purposes.

In one preferred embodiment each tube of said fixed rail is at its lower end provided with a fixing element, which is capable of engagement with a corresponding fixing element provided at the upper end of each of the tubes of said movable rail portion, so that in the aforesaid first position the upper tube of said rail portion is connected to the upper tube of the fixed rail and the lower tube of said rail portion is connected to the lower tube of said fixed rail. By interconnecting the fixed rail and the movable rail portion in this manner the interconnected tubes support each other and an efficient connection has been effected, which is also maintained when the lift passes and thereby causes a slight deformation of the rail.

According to another aspect of the invention said fixing element comprises a portion having a circular cross-section, which portion can be locked in position in a tube of the rail system, as well as a portion which, together with the corresponding fixing element, has a substantially cylindrical outside surface, which corresponds with the outside surface of the tube in question. As a result of this a continuous connection between two contiguous tube

portions can be obtained, as a result of which the elevator can pass the interconnection without any problems.

According to another aspect of the invention each of said pairs of fixing elements being in engagement with each other may comprise a locking provision, which interlocks the fixing elements being in engagement with each other after said engagement has been effected, so that the engagement of the upper tubes as well as that of the lower tubes can be locked.

Preferably the locking provision comprises a co-axial pin, which is movable in axial direction within a fixing element, which pin can be slid to a position within a co-axial hole in the corresponding fixing element. In this manner the tubes are coupled in such a manner that large forces can be transmitted in all radial directions.

When using a rail system comprising two (or more) guides, whereby one rail portion can be moved, the connecting of said rail portion to the other part of the rail constitutes a problem, notwithstanding the fact that the two guides are securely interconnected. Consequently the use of the above-described fixing element with each of the guides separately may be considered to constitute an invention, which may be used in conjunction with any rail system for a staircase elevator comprising more than one guide.

According to another aspect of the invention said guide means comprise a guide member which is connected to said rail portion, near the upper end thereof, and which can be moved along a guideway. The use of a guideway along which a guide member is movable makes it possible to effect any desired movement of the upper end of the rail portion.

Preferably said guide member is pivotably attached to said rail portion, so that said guide member can move along said guideway in a pivoting manner.

Said guide member may thereby be connected to said rail portion via a supporting plate, which is movably attached to said rail portion, whereby the locking engagement between each of the tubes of the rail portion and the corresponding tube of the fixed rail may be effected by moving the supporting plate with respect to the rail portion. The result of this is that when the guide member is moved, the upper end rail portion will also be moved and a locking engagement will be effected when the tubes of the rail system are in line with each other.

According to another aspect of the invention the guide member comprises a portion which can be moved in a slot of said guideway by an endless driving means, which driving means is driven by a stationary electromotor. The use of an endless driving means is a simple method of driving the guide member along the guideway, whilst it is possible thereby for the motor which drives the driving means to be mounted at a fixed location and not on for example the rail portion, so that the rail portion does not have to support any additional weight.

In a preferred embodiment said driving means is an endless chain, preferably a roller chain. Said chain may be passed over chain wheels, whereby one chain wheel is driven by said electromotor. The chain may furthermore be guided along a guide surface, so that the chain moves in the desired path. One of said chain wheels may thereby be connected to a hand wheel, so that the endless driving means can also be driven in case of a power cut or a

breakdown of the electromotor. Preferably said hand wheel is mounted on the shaft of the driven chain wheel. Furthermore a slip coupling may be provided between said electromotor and said driven chain wheel, so that the drive is interrupted when the rail portion meets with resistance while moving. By making the rail portion light in weight, for example because the electromotor is not mounted on the rail portion, said portion can be moved by using relatively little force, so that the slip coupling may be adjusted such that only a small torque can be transmitted.

The above-described mechanism comprising an endless driving means and a stationary electromotor may also be used combined with other components of the guide means besides the ones already described before. Consequently said mechanism may be considered to constitute an invention, which may generally be used for moving a rail portion of a staircase elevator.

The invention furthermore relates to a method for moving aside a movable rail portion of a rail system for a staircase elevator as defined in more detail in the claims.

Further aspects of the invention, which may be used both separately and combined with each other, are described with reference to the Figures and defined in the claims.

Below a few embodiments of a rail system will be explained by way of illustration, whereby reference will be made to the drawing.

Figures 1 - 4 is a view of the lower part of a rail system, showing several positions of a movable rail portion;

Figure 5 is a detailed view of a connecting element;

Figure 6 shows another detail of the rail system;

Figures 7 and 8 are detailed views of a connected rail portion;

Figures 9 and 10 show a connecting element for a tube;

Figures 11 - 14 show fixing elements of the rail system, which are provided with a locking mechanism;

Figures 15 and 16 show the lower part of a rail system comprising alternative guide means;

Figures 17 - 20 show the operation of the guide means of the embodiment of Figures 15 and 16;

Figure 21 shows details of the guide means; and

Figure 22 shows a detail of the drive mechanism of the guide means.

The Figures are merely diagrammatic illustrations of the embodiment, wherein like parts are numbered alike. Furthermore the illustrations of parts which are positioned behind other parts are continued in a number of Figures, as if the parts were transparent.

Figures 1 - 4 show a staircase with steps 1 and a floor 2 at the bottom side. On the side of the staircase, for example near a wall along which the staircase is mounted, a post 3 is provided, to which the rail of the rail system is attached. Post 3 consists of a tube bent to a U shape,

which rests on floor 2 with one leg and on the first step 1 of the staircase with the other leg.

Mounted along the staircase is a fixed rail, which comprises an upper tube 4 and a lower tube 5. A rack 6 is mounted along lower tube 5, which rack is capable of meshing with a driven gear of the elevator, so that the elevator can move along the rail.

The rail system is provided with a movable rail portion comprising an upper tube 7 and a lower tube 8, whereby lower tube 8 is likewise provided with the aforesaid rack 6.

Figures 2 and 3 show the manner in which rail portion 7,8 can be moved between the aforesaid first position illustrated in Figure 1, in which rail portion 7,8 is contiguous to the fixed rail 4,5, and the telescoped position illustrated in Figure 4, in which movable rail portion 7,8 is positioned under the fixed rail 4, 5. In order to carry out this movement rail portion 7,8 is provided with guide means, which consist on the one hand of a guideway construction 9, which guides the upper side of rail portion 7,8 in a selected path, and a connecting element 10, which guides the lower side of rail portion 7,8.

Guideway construction 9 is provided with a guide slot 11 occupying a fixed position with respect to the staircase, which guide slot comprises a rack along one edge, along which a gear 12 can move. Gear 12 is thereby driven by means of an electromotor 13, which is mounted on a baseplate 14, which is capable of movement along guide slot 11. During this movement the upper end of rail portion 7,8

is caught, so that said upper part first moves obliquely downwards from said first position, in which rail portion 7,8 is contiguous to fixed rail 4,5 (Figure 1), and subsequently to a telescoped position (Figure 4).

Near the lower end the rail portion is guided by means of connecting element 10, which consists of two portions, a first portion 15, which can pivot with respect to post 3 about a fixed first pivot pin 16, and which can pivot with respect to the second portion 18 of fixing element 10 about a second pivot pin 17. Second portion 18 is pivoted to tube 8 of movable rail portion 7,8 about third pivot pin 19.

Tubes 7 and 8 of the movable rail portion are interconnected by cross connection 20 near their lower ends and by connecting plate 21 near their upper ends.

From Figures 1 - 4 it appears that when rail portion 7,8 telescopes, the lower end thereof is guided in that first the second portion 18 of connecting element 10 pivots about pivot pin 17 to a position in which said second portion 18 strikes a stop (not shown) of rail portion 7,8, after which first portion 15 of connecting element pivots about first pivot pin 16 to the final position shown in Figure 4. Rail portion 7,8 is similarly returned to the first position in reverse order.

Since connecting element 10 is fitted with two pivotably interconnected portions 15,18, the lower end of rail portion 7,8 is prevented from moving in a circular path about a fixed point (first pivot pin 16), whereby said lower end is moved up so far that it cannot be positioned under the lower tube 5 of the fixed rail, because it might slope too much with respect to said tube.

Especially when the two tubes of the rail are spaced further apart, which leads to an advantageous distribution of forces for the elevator, less space will be available under the fixed rail for moving aside the rail portion, which will also be higher in that case.

It will be apparent that the desired movement of the lower end of rail portion 7,8 is achieved in that first the two portions 15,17 of connecting element 10 will pivot with respect to each other when rail portion 7,8 is being moved, so that the spacing between first pivot pin 16 and third pivot pin 19 will be reduced temporarily during said movement.

Figure 5 shows the connecting element 10, wherein first portion 15 is illustrated in partially cut-away view. The Figure illustrates the manner in which first portion 15 of connecting element 10 is provided with an adjustable (by means of screw 22) stop 23, which butts against a cam 24 of the post (3). In this manner the lowermost position of first portion 15 can be precisely adjusted, and that in such a manner that rail portion 7,8 is exactly in line with fixed rail 4,5.

Figure 6 shows the connection between the upper end of rail portion 7,8 to the lower end of fixed rail 4,5. The four ends of the tubes 4,5,7,8 are each provided with a fixing or engaging element 25, which elements are capable of engaging each other in pairs. The engaging elements are configured such that each pair of elements forms a substantially cylindrical outside surface in the engaged position of said elements.

After the respective tubes 7,4 and 8,5 have been moved from the position shown in Figure 6 to a position in which they engage each other (see Figure 7), gear 12 moves further through guide slot 12, whereby connecting plate 21 moves obliquely downwards, as is shown in Figure 8. Connecting plate 21 thereby effects an interlocking engagement between the respective pairs of tubes 4,7 and 5,8, such that said tubes can no longer move in transverse direction with respect to each other.

Figures 9 and 10 are detailed views of engaging element (connecting element) 25. The engaging element is provided with a cylindrical portion 26, which can be slid into a tube 4,5,7,8 and be secured in position therein, for example by means of a fastening bolt (not shown). The part of engaging element 25 projecting from tube 4,5,7,8 has the same outside diameter as the tube, so that a proper contiguity is obtained. This part of the engaging element is provided with a hook-shaped portion 27, which is configured such that two interlocking hook-shaped portions have a substantially cylindrical outside surface.

As is apparent from Figure 10, the engaging element comprises a flat side 28, which is provided with a screwed hole 29, by means of which said engaging element can be attached to the connecting plate or to the aforesaid locking means. A recess 30, in which a circular shaft may be placed, is formed centrally and co-axially in said engaging element. An adequate lateral fixation of the two engaging elements is effected by mounting such a circular shaft in one of the two engaging elements of a pair of engaging elements.

Figure 11 shows two corresponding attaching elements which may be moved into engagement with each other as shown in Figure 13. Each attaching element consists of an engaging element 25, which has the same outside diameter as tube 7,8. The cylindrical portion 26 of engaging element 25 is mounted within tube 7,8.

In Figure 11 the left-hand connecting element is provided with an axially movable pin 31, and the right-hand connecting element is provided with a co-axial recess 30, into which pin 31 can be slid when the connecting elements are in engagement with each other, as is shown in Figure 13.

Figure 12 shows the connecting element that corresponds with the left-hand connecting element according to Figure 11, in this case in sectional view perpendicularly to the section of Figure 11, however. Figure 12 shows an operating lever 32 which is pivotable about pin 33, by means of which lever pin 31 can be moved in axial direction. Figure 14 shows the axially moved pin as it is also shown in Figure 13, wherein pin 31 has been moved into recess 30 by the pivoting of lever 32.

A very reliable locking engagement can be obtained in the manner shown in Figures 11-14, whereby large forces can be transmitted in all radial directions between the interconnected tubes, whilst the tubes will remain exactly in line with each other.

Figures 15 and 16 show the bottom side of a rail system in the manner as shown in the previously discussed Figures 1 and 4. The rail system as illustrated in Figures 15 and 16 differs from the rail system according to Figures 1-4 in

that alternative guide means are present for guiding the upper end of the movable rail portion. Figures 15 and 16 show a front view, so that tubes 4,5,7,8 are shown positioned in front of post 3, and rack 6 is hidden from view, because it is mounted behind tubes 5,8.

Figure 15 is a view of the rail system showing movable rail portion 7,8 to be contiguous to fixed rail 4,5, and Figure 16 shows the situation wherein said movable rail portion has been moved to a position under fixed rail 4,5.

The guide means at the lower ends of the rail portion are identical to the guide means shown in Figures 1-4. A guide member 34 is pivotably mounted at the upper end of the rail portion, said guide member comprising a portion which is capable of movement within the slot 48 forming the guideway of the guide means. Guide member 34 is moved along said slot by means of an endless chain, whereby the chain wheel driving said chain is present at the location indicated at 36.

Figures 17-20 show the manner in which the upper end of the rail portion 7,8 is moved. Some parts are transparent in said Figures, in order to illustrate their operation more clearly.

Figure 17A shows the situation in which fixed rail 4,5 is in line with movable rail portion 7,8. The corresponding connecting elements 25 are in engagement with each other thereby and guide member occupies an extreme position in the guideway along which guide member 34 can be moved. Guide member 34 comprises two pins 35,36, which are positioned in guide slot 48. As a result of that slot 48 not only determines the path in which guide member 34 can

move, but also the pivoting motions which are made during the movement of guide member 34.

At the location of pin 36 guide member 34 is attached to an endless chain 37, which is passed over a driving chain wheel 38, a non-driven chain wheel 39 and a guide plate 40.

The electromotor 41 driving chain wheel 38 is mounted perpendicularly to the axis of said chain wheel 38.

Figure 17B is a plan view of the device of Figure 17A. The Figure thereby shows how pin 31 has been moved to the locked position by means of lever 32. The pivoting of lever 32 is thereby effected in that supporting plate 42 is moved in axial direction with respect to said rail. In order to make said movement possible supporting plate 42 is connected to rail portion 7,8 via slotted holes.

Figure 17B furthermore shows the two plates 43, 44 between which chain 37 is provided. Figure 17B also shows that guide member 34 extends beyond said plates 43, 44, so that the pins 35,36 can extend through said plates 43, 44, which are provided with guide slot 48.

Figure 18A shows the situation in which chain 37 has slightly moved guide member 34, whereby pin 45 of guide member 34, by means of which guide member 34 is attached to supporting plate 43, has only moved in axial direction with respect to the rail. As a result of this movement pin 31 (Figure 18B) has been moved to the left by the pivoting of lever 32, so that the connecting elements engaging each other are no longer interlocked.

Figure 19 shows the situation in which guide member 34 has been moved further along the guideway, whereby the upper end of rail portion 7,8 has been moved substantially downwards, to be subsequently moved to a position under fixed rail 4, 5 (Figure 20).

Figures 21A,21B and 21C show parts of the guideway, namely the two plates 43,44 in which guide slots 48 are provided, and a portion 46, which is positioned between the two plates 43,44 in mounted condition. Figure 21A furthermore shows chain wheel 39 and guide plate 40. The Figure shows the location at which the two parts are mounted on plate 43.

Figure 22 shows a detail of the drive mechanism, showing electromotor 41, which is mounted perpendicularly to the axis of the chain wheel 38 driving chain 37. A hand wheel 46 is mounted on chain wheel 38 in order to be able to rotate chain wheel 38 in case of a breakdown of electromotor 41 or in case of a power cut.

The embodiment explained above and illustrated in the Figures is merely to be considered as an illustrative embodiment of the invention.

CLAIMS

1. A rail system for a staircase elevator, whereby the rail comprises two tubes having a substantially circular cross-section, which are mounted substantially one above the other in spaced-apart relationship, said rail system being provided with a rail which can be fixedly mounted with respect to the staircase and a rail portion which can be moved by guide means between a first position, in which each of the tubes of said rail portion is contiguous to the lower end of the corresponding tube of the fixed rail, and a telescoped position, in which the two tubes of said rail portion are at least partially positioned under the two tubes of the fixed rail.

2. A rail system according to claim 1, characterized in that said guide means comprise a connecting element, which is on the one hand pivotably connected to said rail portion, near the lower end thereof, and which is on the other hand pivot-mounted at a fixed location with respect to the staircase, said connecting element comprising a first portion and a second portion, which portions are pivotably interconnected.

3. A rail system according to claim 2, characterized in that said connecting element comprises three horizontal pivot pins extending parallel to each other, a first pivot pin at one end of said first portion, which pivot pin is present at a fixed location with respect to the staircase, a second pivot pin at the other end of said first portion, about which pivot pin also the second portion can

pivot, and a third pivot pin at the end of said second portion, which pivot pin is present at a fixed location on the rail portion.

4. A rail system according to claim 2 or 3, characterized in that in said first position of said movable rail portion said second pivot pin is positioned some distance under the plane in which said first and said third pivot pin lie.

5. A rail system according to any one of the claims 2 - 4, characterized in that an adjustable stop is provided for adjusting the lowermost position of the first portion of the connecting element upon pivoting of said first portion about a pivot pin occupying a fixed position with respect to said staircase.

6. A rail system according to any one of the claims 2 - 5, characterized in that said connecting element is attached to the lower tube of said rail portion and that the two tubes of said rail portion are interconnected, so that the upper tube will move along when the lower tube is being moved.

7. A rail system according to any one of the claims 2 - 6, characterized in that said connecting element and said rail portion are spaced from the floor at the bottom side of the staircase in any position, including said first position.

8. A rail system according to any one of the preceding claims, characterized in that each of the tubes of said fixed rail is at its lower end provided with a fixing element, which is capable of engagement with a

corresponding fixing element provided at the upper end of each of the tubes of said movable rail portion, so that in the aforesaid first position the upper tube of said rail portion is connected to the upper tube of the fixed rail and the lower tube of said rail portion is connected to the lower tube of said fixed rail.

9. A rail system according to claim 8, characterized in that said fixing element comprises a portion having a circular cross-section, which portion can be locked in position within a tube of the rail system, as well as a portion which, together with the corresponding fixing element, has a substantially cylindrical outside surface, which corresponds with the outside surface of the tube in question.

10. A rail system according to claim 8 or 9, characterized in that both pairs of fixing elements being in engagement with each other comprise a locking provision, so that the engagement of the upper tubes as well as that of the lower tubes can be locked.

11. A rail system according to any one of the claims 8 - 10, characterized in that said locking provision comprises a co-axial pin, which is capable of movement in axial direction within a fixing element, which pin can be slid to a position within a co-axial hole in the corresponding fixing element.

12. A rail system according to any one of the preceding claims, characterized in that said guide means comprise a guide member which is connected to said

rail portion, near the upper end thereof, and which can be moved along a guideway.

13. A rail system according to claim 12, characterized in that said guide member is pivotably attached to said rail portion.

14. A rail system according to claim 12 or 13, characterized in that said guide member is connected to said rail portion via a supporting plate, which is movably attached to said rail portion, whereby a locking engagement between each of the tubes of said rail portion and the corresponding tube of said fixed rail may be effected by moving said supporting plate with respect to said rail portion.

15. A rail system according to any one of the claims 12 - 14, characterized in that the guide member comprises a portion which can be moved in a slot of said guideway by an endless driving means, which driving means is driven by a stationary electromotor.

16. A rail system according to claim 15, characterized in that said driving means is an endless chain, preferably a roller chain.

17. A rail system according to claim 15 or 16, characterized by a hand wheel, by means of which said endless driving means can be manually driven.

18. A method for moving aside a movable rail portion of a rail system for a staircase elevator, whereby the rail comprises two tubes having a substantially circular cross-section, which are mounted

substantially one above the other, characterized in that the two tubes of said rail portion are jointly moved under the two tubes of the fixed rail of the rail system.

19. A method according to claim 18, characterized by using one or more features of the preceding claims.

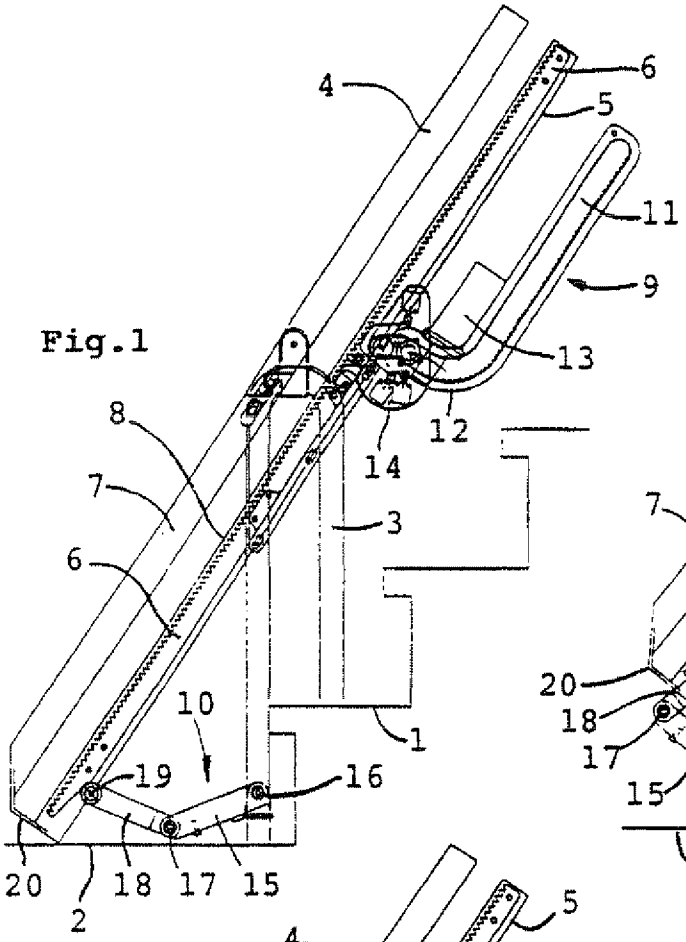

Fig.1

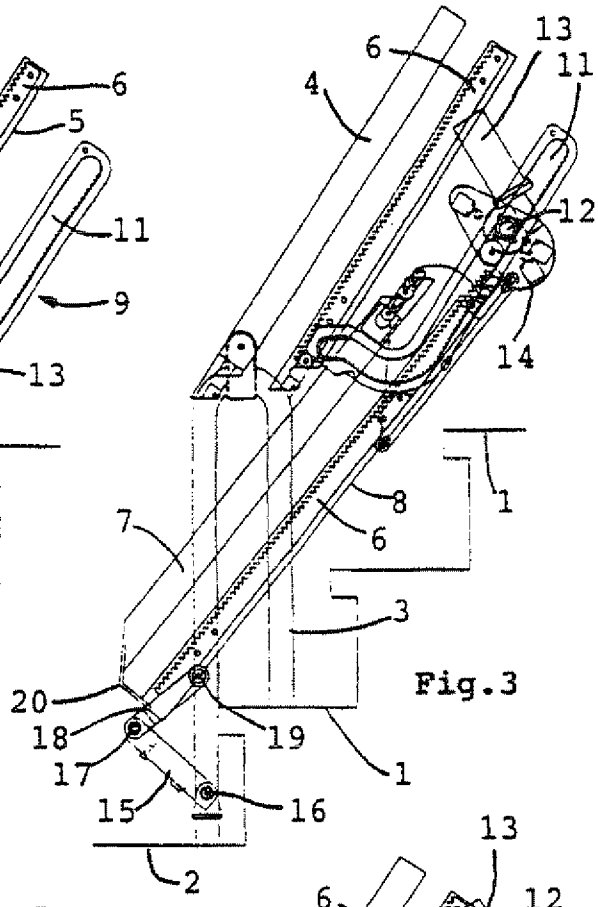

Fig.3

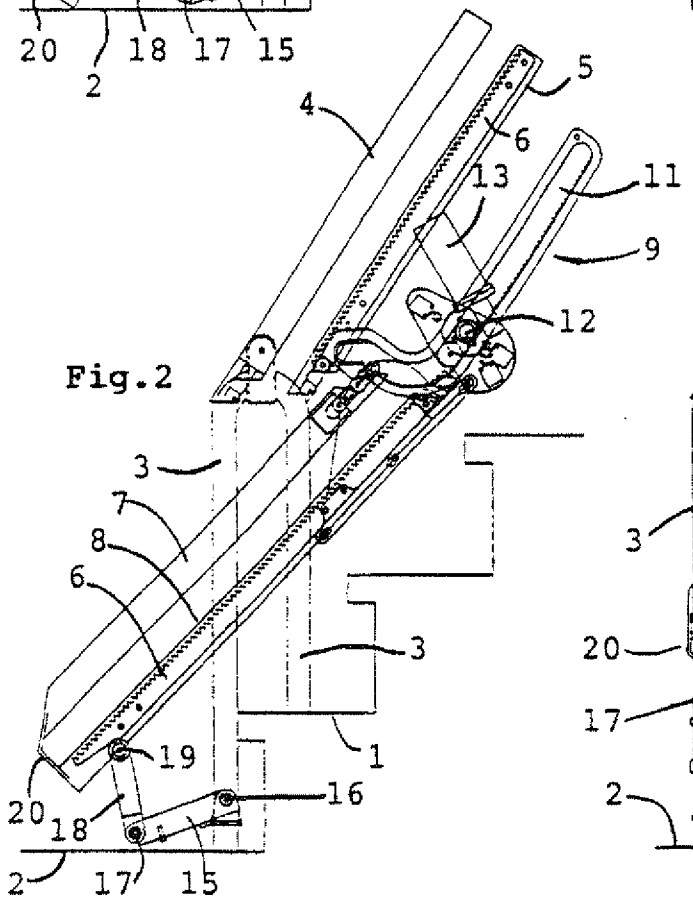

Fig.2

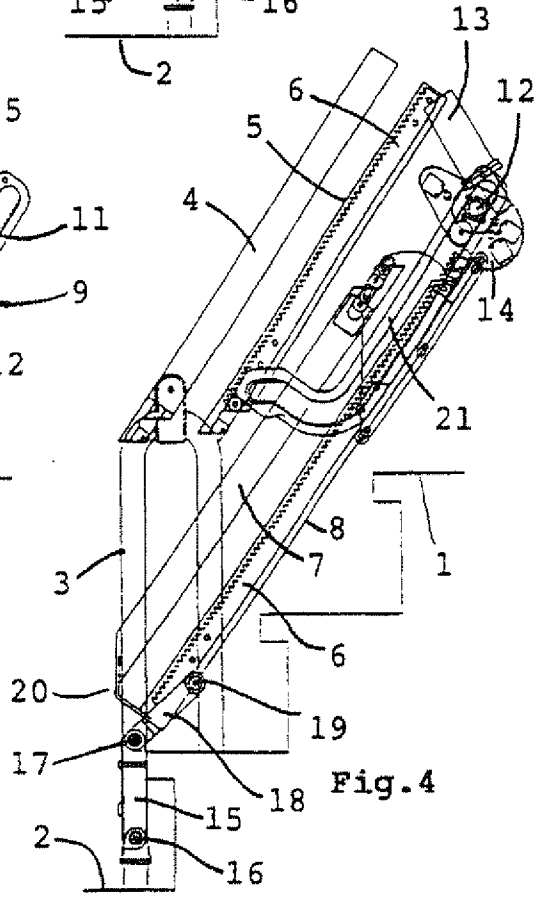

Fig.4

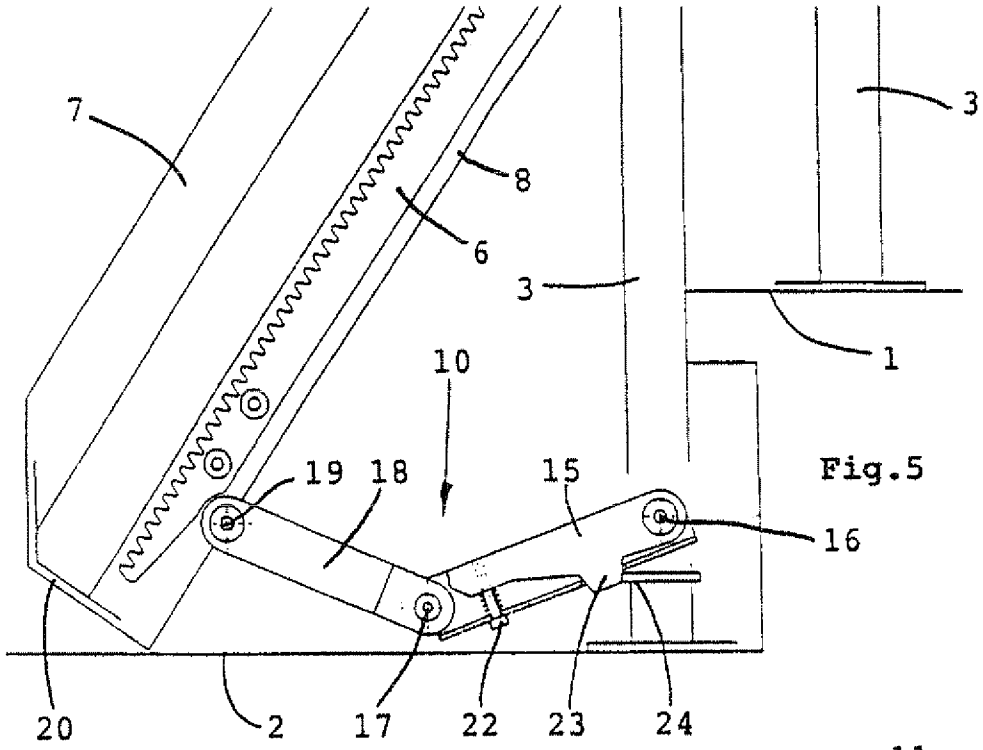

Fig.5

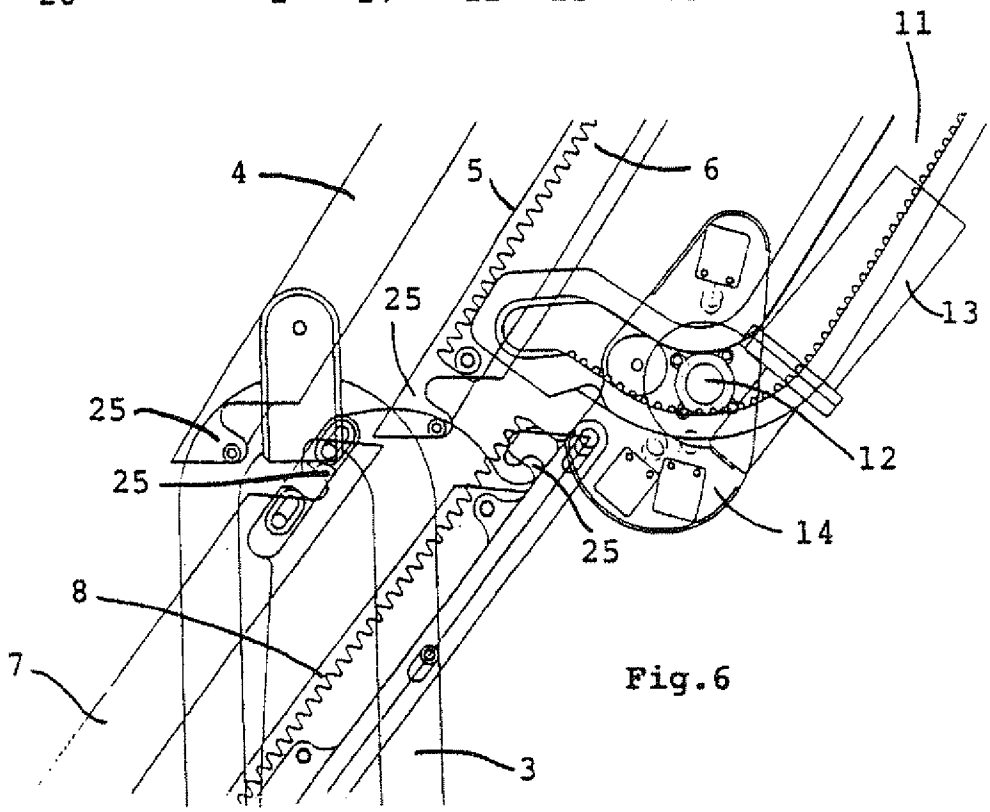

Fig.6

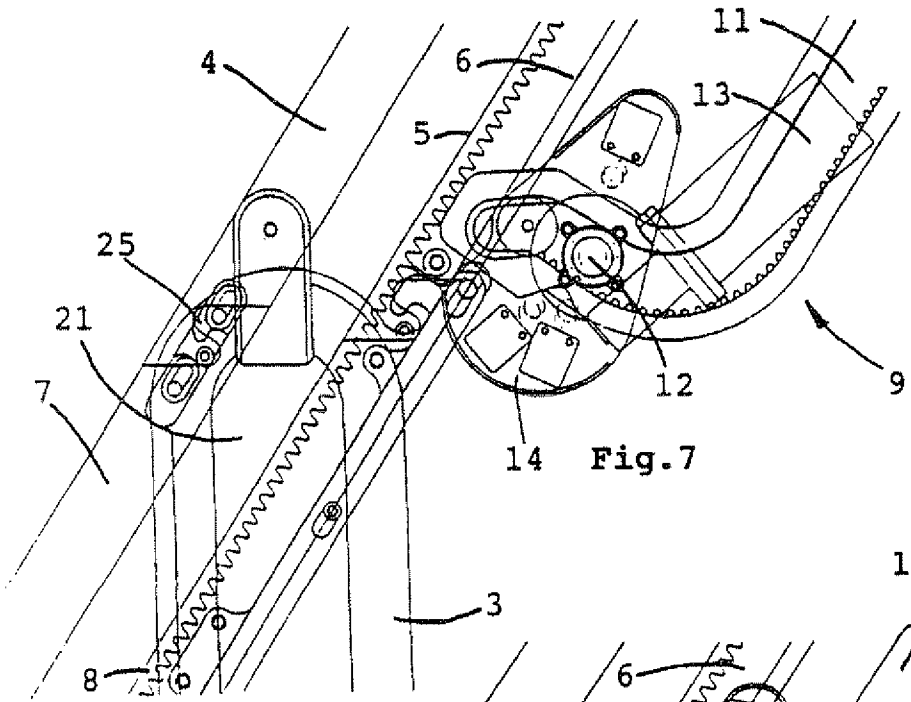

Fig.7

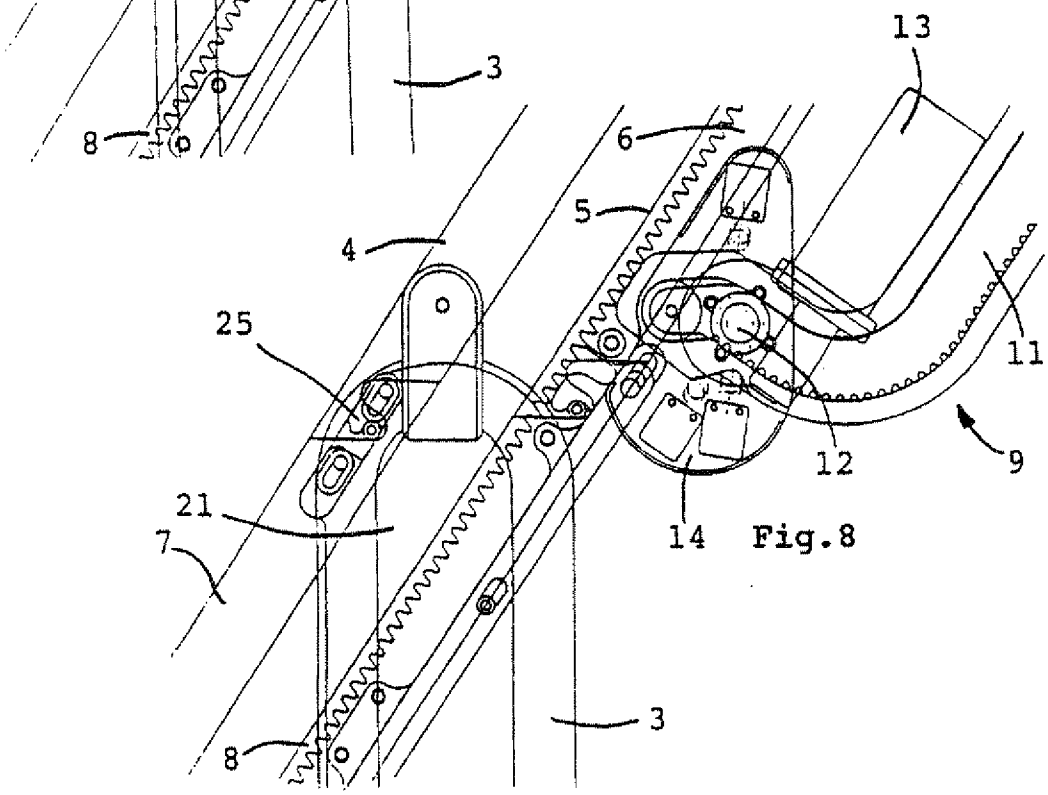

Fig.8

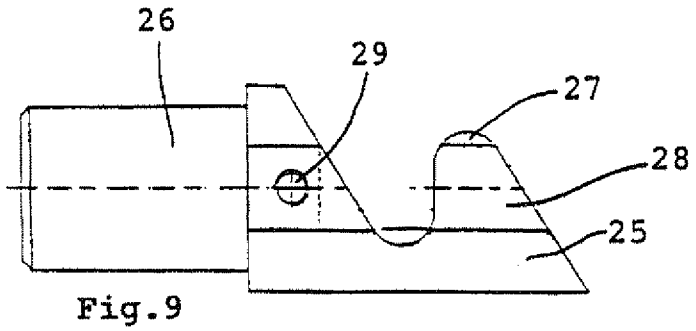

Fig.9

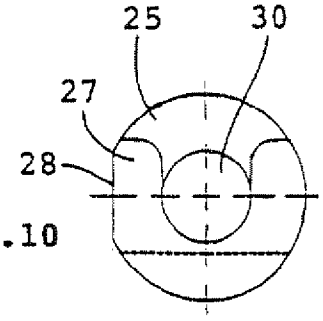

Fig.10

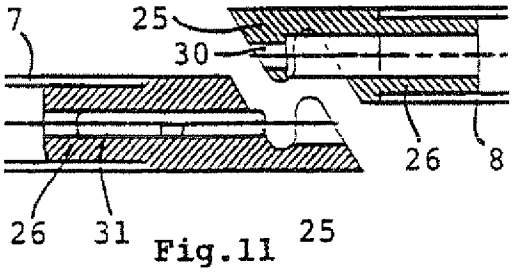

Fig.11

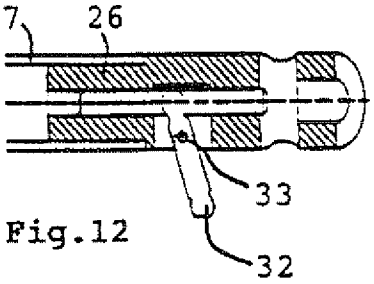

Fig.12

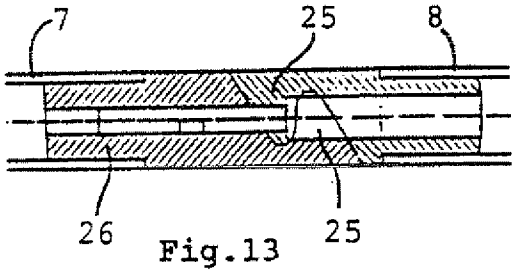

Fig.13

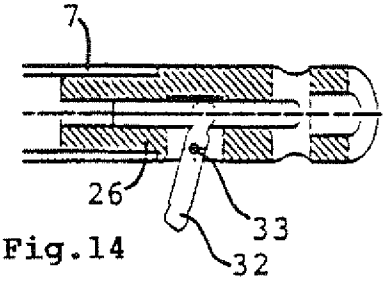

Fig.14

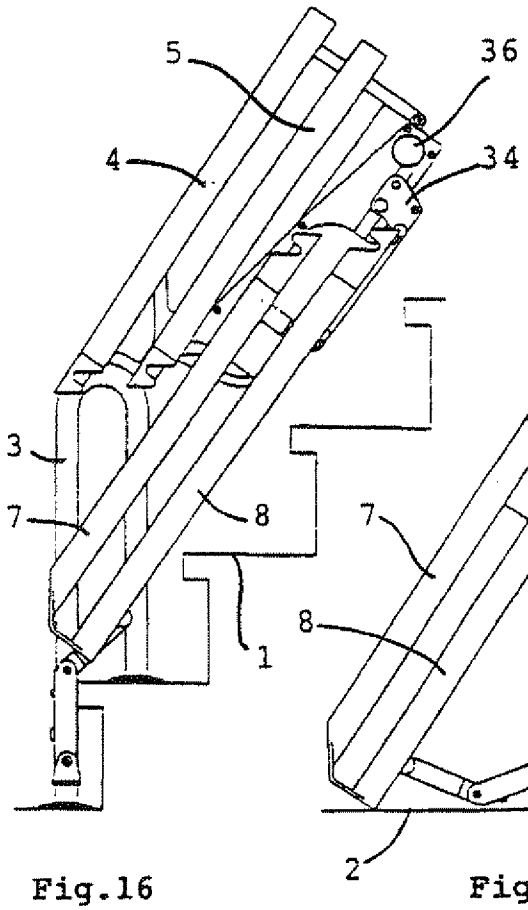

Fig.16

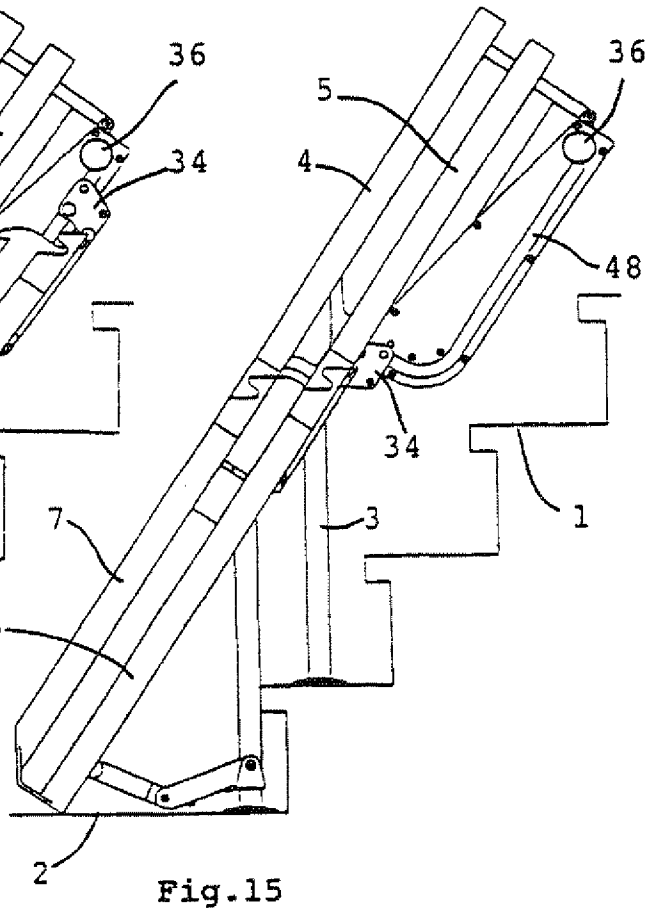

Fig.15

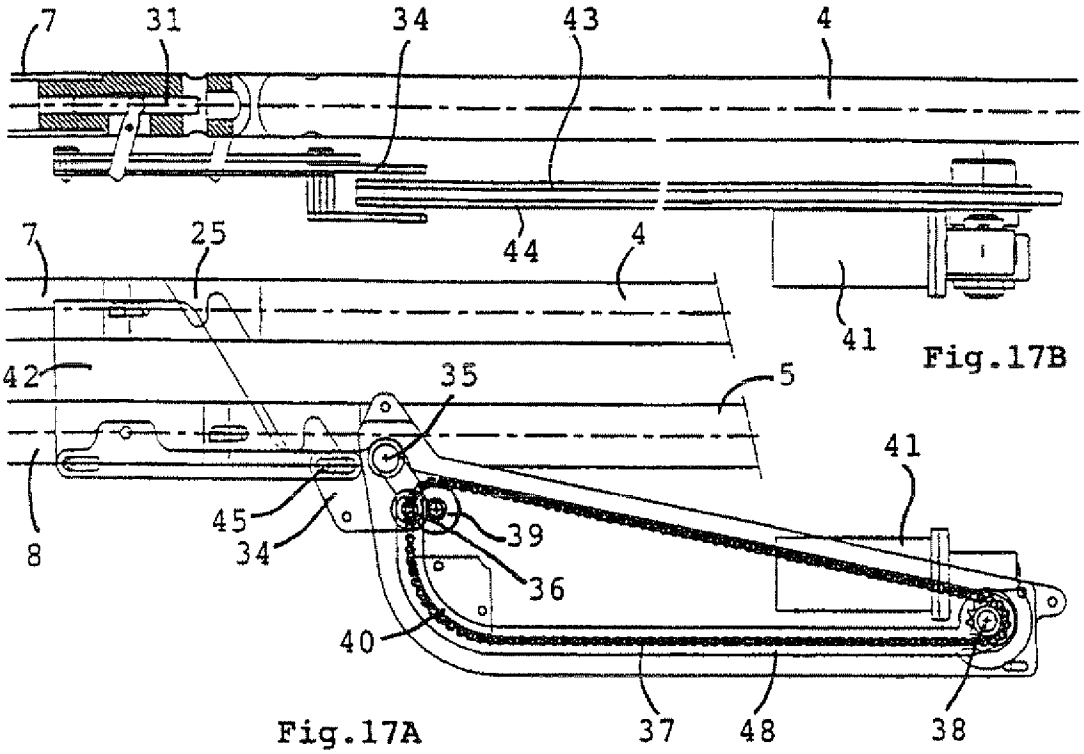

Fig.17B

Fig.17A

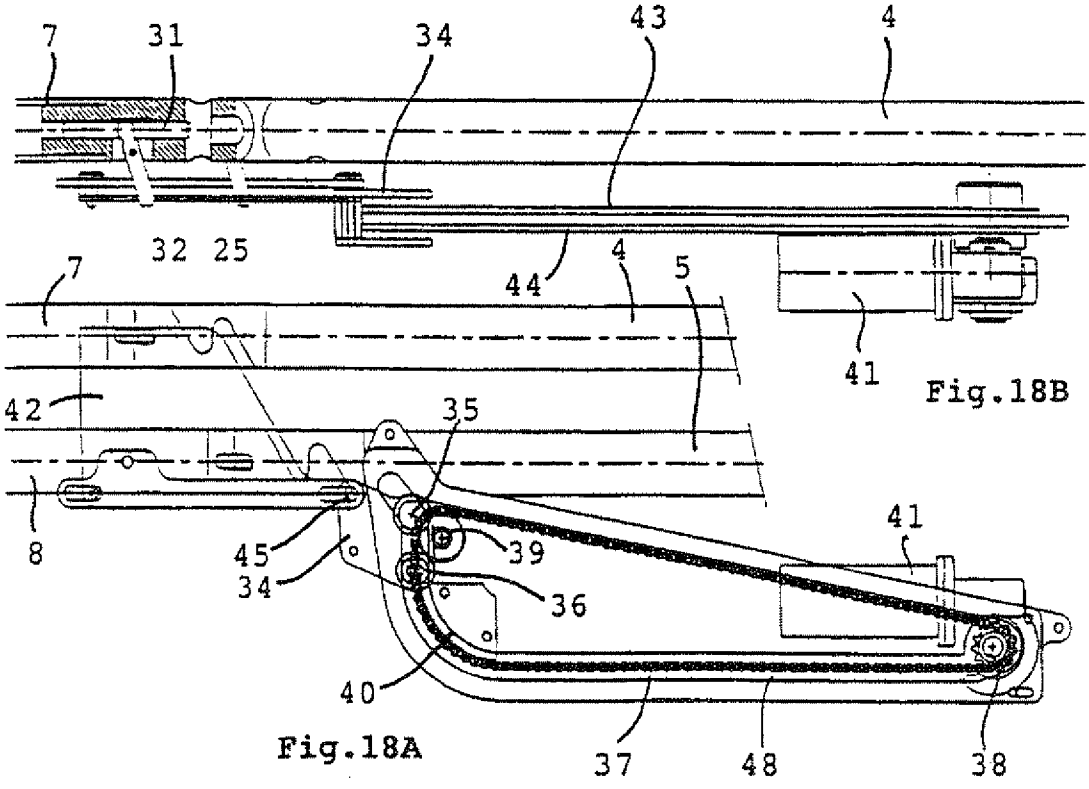

Fig.18B

Fig.18A

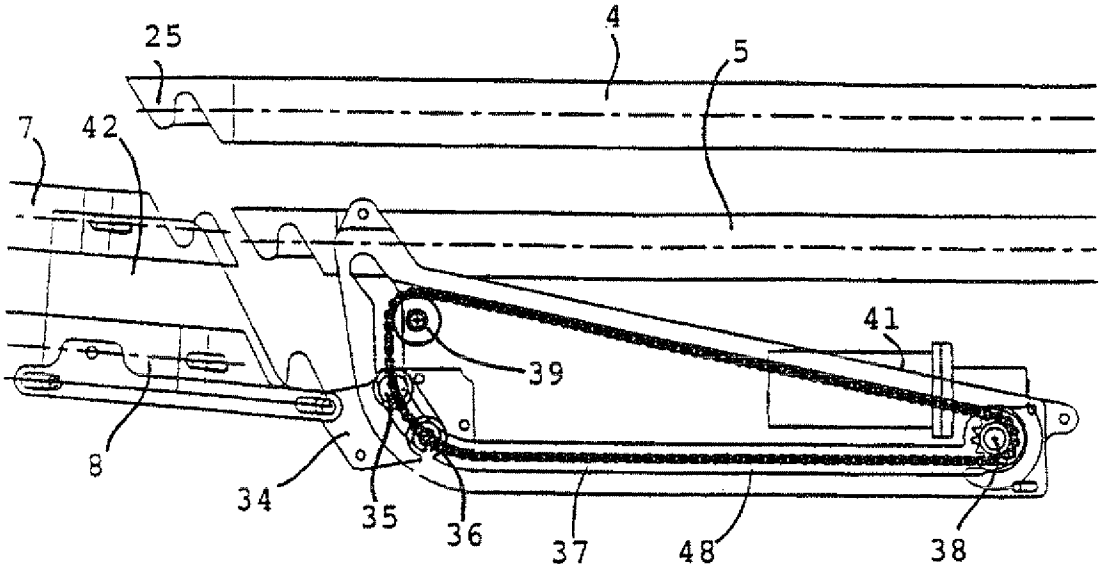

Fig.19

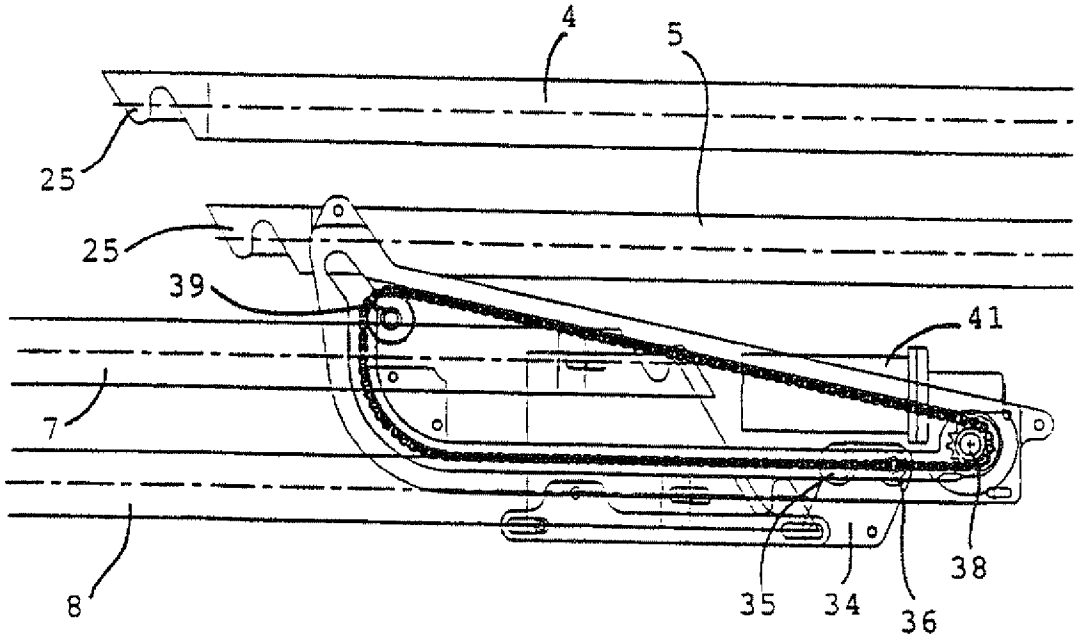

Fig.20

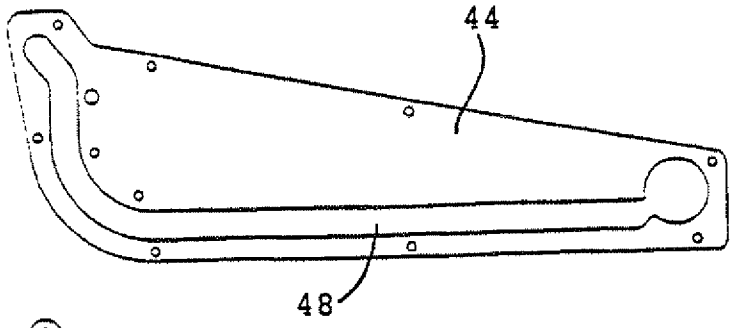

Fig.21C

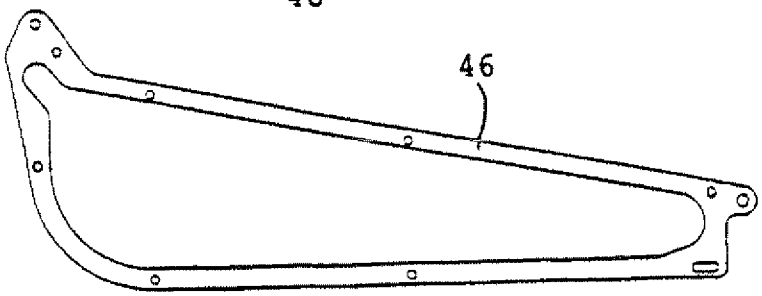

Fig.21B

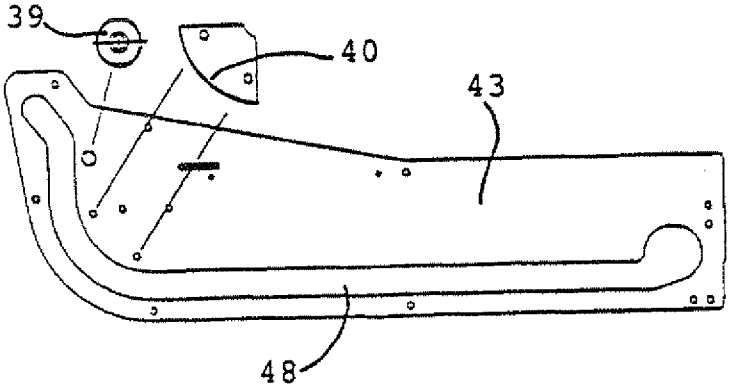

Fig.21A

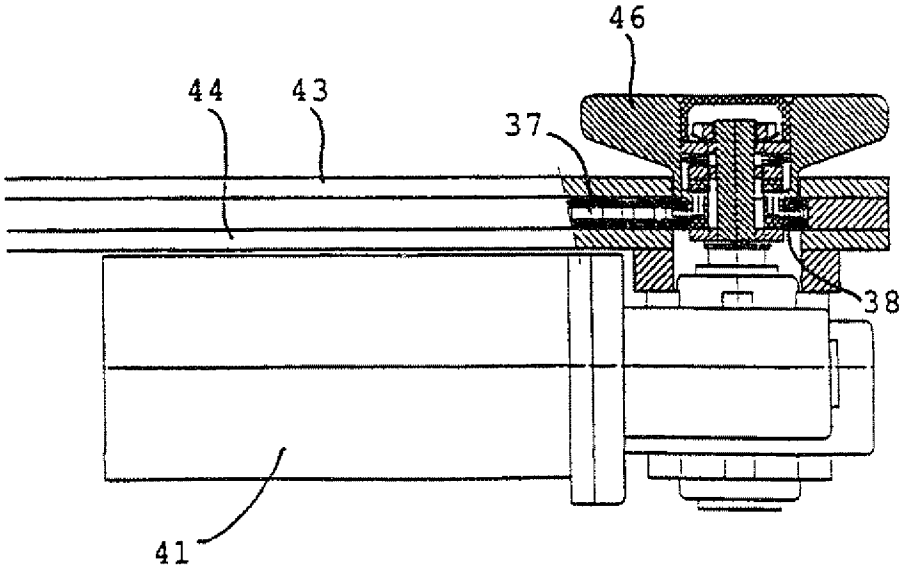

Fig.22

INTERNATIONAL SEARCH REPORT

Internat l Application No
PCT/NL 97/00013

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B66B9/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B66B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 90 08091 A (THYSSEN DE REUS B V) 26 July 1990 cited in the application see abstract; figures 1-4 ---	1,18
A	EP 0 450 858 A (HOLDEN RAYMOND JOHN) 9 October 1991 see abstract; figures 1-6 -----	1,18

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
6 May 1997	29.05.97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Sozzi, R

INTERNATIONAL SEARCH REPORT

Information on patent family members

Interna al Application No
PCT/NL 97/00013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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